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ETHIOPIAN CIVIL AVIATION AUTHORITY

Date 11/5/2001
Ref. C0-5/17/93

**National Transportation Safety Board
Bureau of Accident Investigation
Washington, D.C. 20594
U.S.A**

Dear Sir,

Subject:- Final Accident Report of N350JF Learjet 35A

Enclosed herewith please find the final report of the subject accident which occurred on August 29, 1999 near Adwa Town in Northern Ethiopia.

Accept, Sir, the assurance of my highest consideration.



Sincerely yours,

[Signature]
Meshesha Belayneh
Director General

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Addis Ababa, Ethiopia

AI-4/99

**AIRCRAFT ACCIDENT
INVESTIGATION REPORT
N350JF, LEAR JET 35A ACCIDENT ON THE
29TH OF AUGUST 1999 IN ETHIOPIA**

**Ethiopian Civil Aviation Authority
Flight Safety Department
P.O.BOX 978
Addis Ababa – Ethiopia
April, 2001**

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Synopsis

On the 29th of August 1999 N350JF was being flown to Lanseria, South Africa after being delivered by Corporate Jets Inc to ExcuJet South Africa at the end of a lease agreement which Corporate Jet Inc had made with a company called Lamburne Corporation in 1994. The aircraft last departed Luxor at 1129 utc and it is assumed that this flight had passed through Jeddah FIR before coming under Asmara Air Traffic Control. According to a Flight Plan sent through AFTN to Addis Ababa Air Traffic Control Center from Cairo Airtraffic Control, the flight was expected to proceed along the ATS routes R775, W889 and UG650. The crew however failed to stick to the flight plan routes and was actually found cruising on UG650 ; a route closed between Asmara and Addis Abeba as a result of the Ethio-Eritrian war. During the period that N350JF remained under Asmara Air Traffic Control it was repeatedly advised of the closure of UG650 and of the safety risks that it could encounter if it encroached over the prohibited air space by Asmara. N350JF was hence instructed to intercept radial 100 from Asmara VOR and then to proceed on this radial until it could join one of the ATS routes over the Red Sea leading to the ATS reporting point PARIM from where it could have safely entered the Addis Ababa FIR.

Despite the ample warning given by Asmara Air Traffic Control, N350JF however continued on UG650 and hence entered the withdrawn segment of this route over the Ethiopian territory intentionally. Since this flight was not properly coordinated by Asmara Air Traffic Control with the Air Traffic Control at Addis Ababa, the civilian identity of the aircraft could not be determined when this aircraft was first seen by a military radar heading towards the area designated as a war zone. The aircraft was hence finally shot down by a missile fired by the Ethiopian Ground Force in the area on suspicion that the aircraft was an enemy fighter aircraft coming for a bombing raid. The aircraft was destroyed and the crew killed as the result of the accident.

General Information

General

Registration	N350JF
Type	Learjet
Model	35A
Nationality	USA
Date	August 29, 1999
Time	1331 UTC
Last point of departure	Luxor, Egypt
Point of intended landing	Nairobi, Kenya
Type of operation	Ferry Flight
Phase of Operation	Enroute
Location of Accident	South of Adwa town (N135707.7'E0385431.8')
Pilot_in_command	Mr. Alan Lewis (British)
Second_in_command	Mr. Anders Ingvar Toris Johan (Swedish)

1. Factual Information

1.1 History of Flight

1.1.1 Background History of N350JF

Documents retrieved from the aircraft wreckage indicate that N350JF was the property of an American company Wilmington Trust based in USA. A lease agreement document recovered from the aircraft wreckage revealed that N350JF was leased to Corporate Jets Inc in 1994 by the Geneva based Lamburne Corporation which had control of the aircraft on behalf of the registered owner Wilmington Trust. N350JF was therefore deployed by Corporate Jets Inc for the contract work it had taken from the American Navy based in Naples, Italy. At the end of the lease agreement N350JF was expected to be returned by Corporate Jets Inc to Lamburne Corp. The aircraft was however delivered to ExecuJet South Africa in August 1999.

1.1.2 Advance Arrangement for the Ferry Flight N350JF

In a fax message dated 27th Aug. 1999, and addressed to ExecuJet South Africa, the ExecuJet Scandinavian company asked its South African counterpart to arrange for an overflight & landing permission for the ferry flight N350JF from Naples to Lanseria, South Africa. It provided ExecuJet South Africa the itinerary according to which the ferry flight N350JF was planned to be operated.

Hence, on the 27th of August 1999 overflight permission for N350JF was requested by Manager Aviation Services of ExecuJet South Africa from the Ethiopian Civil Aviation Authority (ECAA). The fax letter for the overflight permission described that the ferry flight would takeplace on the 29th of Aug.1999 along approved ATS routes, & this flight would also avoid flying through the Eritreian Airspace. The letter also carried the estimated time of departure Jeddah (1220 UTC), & the estimated time of arrival Nairobi (1540 UTC).

On the same date, the ECAA faxed its grant of the overflight permit to ExecuJet South Africa. The following was the full content of the permit: *CAA0663 O/FLT PERM is granted for N350JF LR35 OEJN/HKJK on the 29 AUG + 72 HRS leeway via approved ATS ROUTES as per ECAA's current NOTAMS.*

A fax message sent by ExecuJet South Africa to ExecuJet Scandinavia on the 27th of Aug.1999, besides giving a description of the number of countries that had given or from which a permission was still being awaited also warned the Scandinavian Company that the ferry flight should avoid Sudan Airspace, and should revert to Saudi Arabian Airspace as Sudan does not allow American registered aircraft over its airspace. This fax message also provided the itinerary of N350JF to be: LIRN-HELX-HKJK-FALA. The countries that granted overflight or landing permission according to the fax message mentioned above were: Ethiopia, Eritrea, Djibouti, Kenya, Tanzania, Malawi, Mozambique, Zimbabwe and South Africa. Egypt, Saudi Arabia and Yemen were described as the countries from which a reply was still being awaited.

On the 28th of August 1999, another fax message by ExecuJet South Africa addressed to Captain Alan Lewis at the hotel Paradiso described Egypt as having given a technical landing permit, and Yemen an overflight permit. But as Saudi Arabian's reply was not yet received the Captain was notified that he would be advised the soonest the reply was obtained.

On the 29th of August 1999 at 1030 UTC Cairo transmitted by AFTN a flight plan on N350JF to Asmara and Addis Ababa Air Traffic Control centers. This flight plan detailed (see APP E) the routes along which N350JF would proceed as follows:

LXR -R775-DEDLI-R775-WEIJH-R775-ABKAR-R775-DANAK-R775- APDOS-R775-
ASSAB-W889-ADD-UG650-RUDOL-G650-NAK-G650.

The flight plan also provided the estimated time of departure Luxor 1145 UTC, and the estimated elapsed time for OEJD (Jeddah FIR) 0049, HHAA (Asmara) 0150, HAAA (Addis Ababa) 0330, HKNA (Nairobi) 0410 and HKJK (Jomo Keniyata) 0455.

A Lap Top computer carried aboard N350JF, and later recovered undamaged from the aircraft wreckage contained the proposed route (see APP D) N350JF was planning to take during its ferry trip from Naples to Lanseria. The proposed route as depicted in the printout first originates from Italy then goes over the Mediterranean Sea, Cairo FIR, and finally stops at Jeddah. It starts again from Jeddah, and then goes over the North Eastern part of the Sudan

from where it again extends Southwards over Eritrea, and Ethiopia until it finally terminates at Nairobi, Kenya.

1.1.3 Events Before and After N350JF Was Lost

N350JF departed Luxor at 1129 UTC on the 29th of August 1999 as learned from Cairo Air Traffic Control Service in a reply sent through AFTN to an inquiry made on the 30th of August 1999 by the Addis Ababa Air Traffic Control Center.

From the air traffic control communication (see APP A) recorded on the aircraft Cockpit Voice Recorder (CVR), Asmara Air Traffic Control Center is first heard talking with N350JF on VHF 120.7 MHZ while the aircraft was somewhere beyond the reporting point ULONI on UG650. At the start of this conversation, Asmara was heard trying to verify whether N350JF was proceeding via IMDAX & TESOT on the route W180_ over the Red Sea _ after position ULONI. To these verification inquiries, the Co-pilot replied by stating that the flight was proceeding to overhead Asmara and then to position ETKET-on the Ethio_Eritrean border. When Asmara tried again to verify if the flight would be routing after Asmara via W180, SOLIR, ASSAB & PARIM, the Co-pilot answered by specifying UG650 along which the flight would be proceeding after coming over head Asmara. After some more conversation, Asmara finally instructed N350JF to establish radial 100 after Asmara, and told also the flight to proceed via SOLIR, ASSAB, PARIM and Djibouti to Nairobi, stating the reason that the route (UG650) which the crew was intending for the journey was unsafe for navigation. After the receipt of this new route, the crew became engaged in cockpit discussion and the Co-pilot is heard describing the situation by saying "*now we have ah trouble*" which the Captain replied by saying "...*just keep going direct otherwise we're going to be severely embarrassed they always say that but we always go this other route*". After realizing where the proposed diversion would take them however, the Captain became so angry and told Asmara that they were on a fuel critical leg, and asked to know the reason for diverting them out towards Djibouti saying at the same time to Asmara that there was nothing in NOTAMS (according to his knowledge) concerning route restriction. Asmara then responded by asking the crew why it should not proceed via the assigned route to which the Captain replied by saying "*we wish to proceed from Asmara to over Addis*". Asmara then explained to the crew that the route (UG650) it was asking had been closed before one year and was considered a

danger area. It also told the crew that Asmara had no contact with the Addis Ababa Air traffic Control. The Captain accepted the reasons, but asked Asmara again for direct routing. Asmara again explained the unsafe condition of the airspace over the area designated a war zone, and also warned N350JF that a missile would hit it if it went simply in this direction. Asmara then obliged N350JF to accept radial 100 after checking over head Asmara. When Asmara asked the Captain if he had prior knowledge of the closure of this route (UG650) before one year, the Captain answered negative, and once again Asmara informed the Captain about the closure of the route a year ago.

With all these information in mind, the crew continued towards Asmara. In the speech of the Captain heard after Asmara's last mention of the dangerous condition of the route, the Captain is heard speaking to his colleague: "*its because they're not talking to them in there so there's no contact through there*", and after a brief pause he is again heard saying the phrase that sounded very much like "*all over*".

Following this in what appeared to be probably a bad enroute weather, N350JF asked Asmara for level 410, and was cleared to maintain this level at which time Asmara also asked the flight for position estimate ASSAB & PARIM. On reaching flight level 410, N350JF reported to Asmara leveling at this altitude, and it also passed its estimate for Asmara 1330 UTC and ASSAB 1406 UTC. Asmara copied the report, but also asked the flight for its estimate position PARIM. Since the crew could not locate position PARIM easily on a chart, a lot of dialogue took place before the crew finally found it and told Asmara position estimate PARIM 1415 UTC. In the middle of their conversation as the flight approached Asmara, the Co-pilot informed the Captain their coming in close proximity to the border of Ethiopia, and of their possession of an overflight permission over Ethiopia. The Co-pilot showed a slight inclination of asking Addis Ababa during this cockpit chat presumably for direct routing, but he was never heard doing so. One minute before they even checked Asmara, in a way that could make the exact location of N350JF very doubtful, the Co-pilot told the Captain that they were 15 miles to the border. The Captain answered yeh, and also expressed his intention of going past Asmara to see... _ what ever he might have in mind at that time.

Upon reporting overhead, Asmara N350JF was instructed by Asmara to report established strictly on radial 100. The crew accepted the instruction and agreed to report established radial 100. Following this _ Pilot /Air traffic communication _ the Captain asked the Co-pilot to check the serviceability of Asmara VOR. The Co-pilot said nothing about the

condition of the VOR, but mentioned at this time that they were 3 miles to Ethiopia. The captain said "yeh" in reply and was heard at the same time saying that two and half thousands pounds of fuel had been consumed by the flight and that it had been exactly two hours at this time since they were last airborne from Luxor.

Four minutes after reporting overhead Asmara, the crew reported having established radial 100. Asmara then instructed N350JF to report 100 DME. The crew agreed to do so, and while the Captain was reading aloud to himself the computed elapsed time for the various segments along their route, a loud bang that dismayed both pilots occurred six minutes after they had reported overhead Asmara. Both pilots were stunned by the unusual bang and began asking each other as to what it could have been. The Co-pilot suspected if it could have been a SAM. The Captain answered yes but doubted that it could not have been because of the aircraft height. Amidst this conversation, a click sound from the aircraft came on. While the crew was still talking, the tape recording came to an end at a time the real crisis faced by the crew began to unfold.

At 1347 UTC Asmara called repeatedly N350JF on HF, but failed to get a response from this flight. Asmara then called Djibouti, and requested if it had contact with N350JF. Djibouti replied negative contact, but received in the mean time from Asmara estimate PARIM 1415 UTC, and flight level 410 on N350JF. At 1356 UTC Asmara contacted Addis Ababa and advised that N350JF was coming via RASKA, ASMARA and PARIM. After receiving this traffic information, Addis Ababa too called Sanna and Djibouti to inquire if they had contact with N350JF. Both Sanna and Djibouti replied negative contact with N350JF.

At 1533 UTC the Addis Ababa Air Traffic Control center received a call from the Air Force Command Post which inquired if there had been any traffic south of Asmara at around 1300 UTC. The Addis Ababa Air Traffic Control Center then informed the Command Post about N350JF adding in the mean time also that it had no contact with the flight. At 1545 UTC Addis Ababa requested Asmara the route that N350JF had been flying. Asmara then replied that N350JF was routed via Asmara, Assab and PARIM. This information was again given to the Command Post by the Addis Ababa Air Traffic Control Center.

1.1.4 The Defense Force Account of Events leading to the Demise of N350JF

At 1325 UTC a target at around Asmara was observed by radar surveillance. This target aircraft designated 308 was seen having a speed of 720 km/hr. a height of 11.7 km and a heading that went southerly over the Zala Anbessa Front towards Ethiopia.

The Air Traffic Control at Addis Ababa, asked for any aircraft information either exiting from or entering into Asmara, confirmed the non-existence of any such aircraft at the moment. Since the target aircraft was sighted on an area over which an aerial training exercise had been conducted by the Eritrean Air Force in the morning, the intruder aircraft was initially thought of undergoing the usual training, and there had been some relaxation of vigilance by the Air Defense unit as the result of the misconception so created.

In the morning of the day, this unidentified aircraft made the incursion across the no-fly zone, the Eritrean Air Force fighter aircraft were observed undergoing training exercise along the Zala Anbessa Front, sometimes coming very close to the Front after taking-off in tandem and single from Asmara Airport. Most of the fighter aircraft observed had a speed of 1070 km/hr. The training lasted up to 0800 UTC with several sorties being made until noon.

Therefore, the intruder aircraft was first mistaken for these training flights, but when the aircraft came very close to the border, order was given to declare readiness to missile squadron. As the target aircraft crossed the border and headed towards Adwa town, the radio-monitoring unit of the Army was asked for information on the aircraft. The radio unit however, confirmed that the aircraft was proceeding without making any contact. As the target aircraft approached Adwa town, it was observed increasing its speed to 830km/hr, and decreasing its height to 11km. Since the target aircraft reached Adwa town very rapidly, a decision was taken to remove it before it was capable of staging any attack mission. The target was finally destroyed at 1335 UTC south of Adwa town. A search was immediately began, but news of the exact location of the aircraft wreckage reached the search team in the morning of August 30,1999 from the report made to the Police at Adwa town by the Local Administration in the area of the wreckage site. Finally, on the 31st of August, the search team arrived at the wreckage site, and returned with the bodies of the deceased, and their belongings. From the tail number found on the aircraft vertical stabilizer, it was finally determined that the aircraft destroyed by a missile was N350JF.

1.2 Injuries to Persons

Injuries	Crew	Passengers	others
Fatal	2	-	-
Serious	-	-	-
Minor/None	-	-	

1.3 Damage to Aircraft

The aircraft disintegrated in air and fell in pieces over unpopulated rugged country. The wings, engines and the fuselage were found scattered over an area of radius 300 meters.

1.4 Other Damage

No other damage existed.

1.5 Personnel Information

1.5.1 Pilot-in-Command

The captain, 47 years of age held a British Airline Transport Pilot Licence no-124382. He was rated on Learjet 35/25, Citation 1/2/5/Ultra, B727-100/200,Dc-3, and Be20 and An32 aircraft. He had accumulated a total of 7690 flight hours of which 5430 hours were his command time. He had been a freelance pilot till he died in this accident.

1.5.2 Co-pilot

The Co-pilot, aged 48 years held a US ALTP and a Swedish ATP. He had a total of 10,200 flight hours of which 8,815 hours were as pilot-in-command. He had become a freelance pilot after serving as a full time corporate pilot.

1.6 Aircraft Information

The aircraft was Gates Learjet 35A, Serial No 35-219 and registered by the FAA as N350JF. This aircraft was leased in 1994 by Corporate Jet Inc from Lamburne Corporation which had control of the aircraft on behalf of the registered owner Wilmington Trust.

1.6.1 Equipment

The aircraft was equipped with the following communication and avionics equipment:

H.F Radio Collins 718u-5

Dual Transceivers Collins VHF-200

DME Collins DME-40

Dual ADF Collins DF-60

Dual RMI'S Collins 332c-10

Weather radar RCA Primus 400

GPS Nav System KLN 90B

1.7 Meteorological Information

The general seasonal weather condition of the area over which N350JF was flying on the day of the accident looked like the following:

- a. Cloud 5-6/8 cu+sc+cb, base from MSL 8000-12500 ft
 4-5/8 As+Ac, base from MSL 14000-16000 ft
- b. Surface Visibility 8 to 9 km, but less during rain, mist or fog.
- c. General sky condition -Cloudy occ broken
- d. Surface Wind- southerly and south westerly, at average speed of 04m/s.

Remark Sometimes light continuous rain with low ceiling clouds and fog in the morning and usually rain showers with thunder activities in the afternoon.

1.8 Aids to Navigation

The following navigation aids were available at Asmara Airport:

Asmara VOR: Freq. 113.7 ASM

Asmara NDB: Freq. 305 AS

There were no reported discrepancies to these navigational aids on the 29th of August 1999.

1.9 Communication

Asmara Air Traffic Control established VHF contact with N350JF, while the aircraft was flying on UG650 towards Asmara. The aircraft remained under Asmara control for at least half an hour before it disappeared.

Addis Ababa, Djibouti and Sanna did not establish any radio contact with N350JF. Djibouti received traffic information on the flight from Asmara at time 1351 UTC, and Addis Ababa at 1356 UTC from Asmara as well. Sanna was however given the traffic information later by the Addis Ababa Air Traffic Control Centre. The tape recording of the Air Traffic communication between these ground stations was made available by the Addis Ababa Air Traffic Control Center to the Investigation Committee.

1.10 Aerodrome Information

International Airports suitably located in relation to the flight plan route filed by the crew were available along the route, and these Airports were open to receive N350JF for any eventualities. In their order of significance these Airports were Asmara, Djibouti, DireDawa, and Addis Ababa International Airports.

1.11 Flight Data Recorders

It is not known whether the aircraft was fitted with a Flight Data Recorder (FDR) or not. Available evidences however, indicate that it was not equipped with an FDR. Nonetheless, the aircraft was fitted with a Fairchild GA100 Cockpit Voice Recorder (CVR). The CVR was recovered from the wreckage site intact; it sustained some degree of burn and deformation. An attempt was made to replay the tape locally, but due to the requirement of a better facility for better reading, the tape was finally shipped to the UK and readout and transcribed at the Air Accidents Investigation Branch facility. The tape contained 32 minutes of useful voice communication of the crew and Asmara Air Traffic Control. A very small portion of the tape recording is assumed to be missing as a result of a tape damage.

1.12 Wreckage and Impact Information

The area over which the aircraft wreckage came down is a rugged terrain covered with sparse trees and bushes. The area is unpopulated and it is surrounded by very high ground to the East and North. The area is locally called Segly and lies 25km south of Adwa town.

Wreckage Distribution

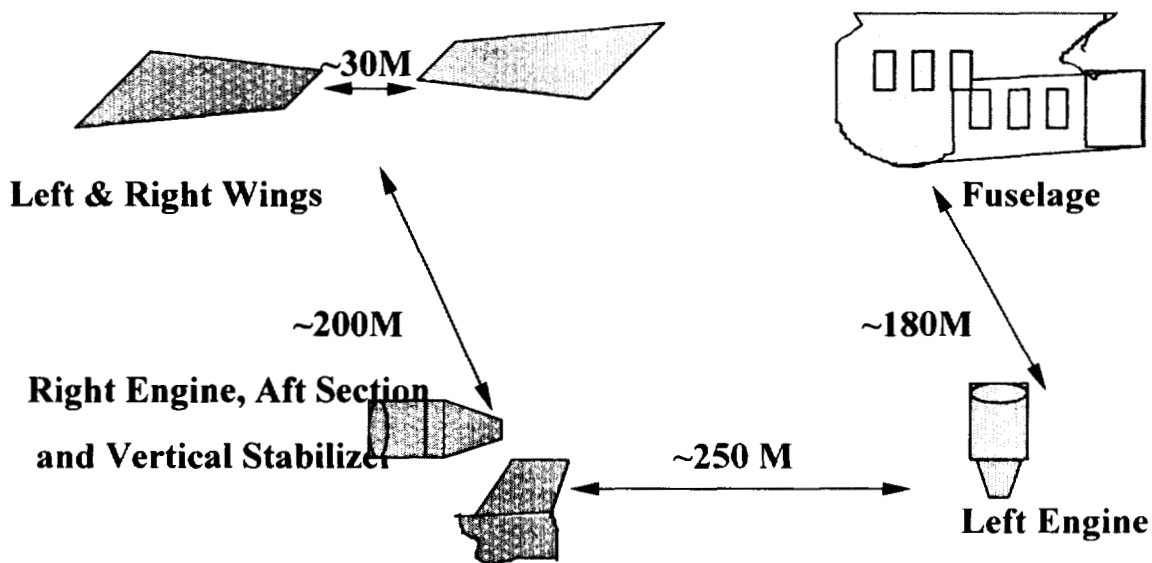


Figure 1

The general distribution of the wreckage looked somewhat similar to the wreckage chart shown in figure 1. Both wings were found separated and resting on a hill 30 meters

apart. The wing tip fuel tanks were missing from both wings. The right engine and the vertical stabilizer lay some 200 meters on the slopping side of another hill away from the wings. This engine was found detached, but intact. It showed severe fire burn and heavy impact damage. While some portion of the aft section was still on the vertical stabilizer, the horizontal stabilizer was missing and was not located anywhere in the area. The left engine was found some 250 meters from the other engine; it was severely damaged by impact. This engine was also found intact. There was no any trace of fire on this engine. The whole fuselage was found shattered and confined in a dry riverbed about 180 meters from the left engine. The whole wreckage came to rest in general over an area of radius 300 meters.

1.13 Medical and Pathological Information

The body of the Captain was found flung outside the cockpit some 50 meters from the fuselage wreckage. The Co-pilot was found trapped in the aircraft wreckage still strapped in his safety belt. Pathological examinations indicated that both pilots sustained multiple major traumas that caused immediate death.

1.14 Fire

The right engine sustained severe fire burn. The aft section, which came off with the vertical stabilizer, showed also some indication of fire attack.

1.15 Survival Aspects

The accident was not survivable.

1.16 Search and Rescue

Following the downing of the intruder aircraft, a search was begun at 1350 UTC using missile launching data, and radar information in three directions. However, the fall of darkness and the prevailing bad weather condition prevented the search conducted by a

helicopter. The ground search continued till noon the following day, but no trace of the whereabouts of the aircraft wreckage was discovered until this time.

News of the crash site however reached the search team sometimes later on from the Police in Adwa town which managed to get the information from the report of the local people, and Police in the area where the aircraft finally came down. The search and rescue team reached the crash site in the early morning of August 31, 1999. The team found the aircraft wreckage and the bodies of the crew under the custody of the local people, and Police who had been on the site from the time the aircraft had crashed. The bodies of the deceased were transferred to Adwa and then to Makale town on the same day.

1.17 Additional Information

1.17.1 Deployment of Armies along the Ethio-Eritrean Border

Ever since the two neighboring countries went into war, there has been a large deployment of soldiers, and armament along the contested common border starting from the Bure Front near Assab to Humera at the Sudan border by both countries. Several battles that caused huge casualties both human and material on both sides were fought by these countries, and their armies are still found in confrontation.

1.17.2 The Unresolved Problem of FIR Question

Before Eritrea got its independence in 1994, the airspace over the territorial limits of Eritrea including a section of the airspace over the Red Sea was under the Addis Ababa Flight Information Region (FIR). With the attainment of independence however, Eritrea showed interest to establish its own Flight Information Region, and did so by implementing a defacto FIR and publicizing it in a NOTAM in 1998. Ethiopia has not accepted this unilateral action, and still insists that the issue must be viewed from the technical and operational aspects, and that the establishment of such a FIR must obtain the acceptance and agreement of concerned countries in the subregion.

Because of these conflicting stands, control of international traffic has remained very problematic, and the condition is further aggravated by the emergence of hostilities between

the two countries. Asmara requires that all traffic operating within the airspace it has designated as Asmara FIR to receive all clearances from Asmara Air Traffic Control Center. Adjacent FIRs like Jeddah release or provide traffic information to Asmara only in recognition of Asmara's stand, even though Addis Ababa is still recognized to be in charge of the air traffic control in the upper airspace over Eritrea. Asmara withholds or prevents traffic information from reaching Addis Ababa. Such mal practices have prevented proper air traffic coordination between the two air traffic systems.

1.17.3 Airspace Restriction

Since hostilities between Ethiopia and Eritrea broke out in 1998, Ethiopia has withdrawn all the ATS routes that lead to the Eritrean airspace or were affected by the war by a NOTAM issued on the 2nd of June 1998. This NOTAM was distributed to all countries, operators and agencies that the CAA exchanges aeronautical information. A replacement to the original NOTAM is sent to every recipient of aeronautical information every two months. Among the countries that are still receiving the NOTAM on the withdrawn routes are Italy, Egypt, Sudan, Saudi Arabia, Yemen, Djibouti etc. These withdrawn routes promulgated in the NOTAM were:

G650, B535, UA408, UB525, UB535, UM665, UR2, UR400, UR995, UR780, UR993, W889 and UA451 partially (see APP E). A Jeppesen Manual containing all these withdrawn routes and belonging to the crew was recovered in good condition from the aircraft wreckage site.

There was only one violation of the airspace prohibited to all kinds of unauthorized aircraft operation prior to the accident to N350JF. And that was committed by an aircraft bound to Uganda on the 4th of June 1999. This aircraft entered the No-Fly Zone from the northwest via ERBUK and was intercepted and forced to land at Bahar Dar Airport. Apart from this isolated incident, there had not been any violation of the airspace declared a war zone, and no civil aircraft had been permitted to fly over the No-Fly Zone ever since the airspace restriction was imposed. Eritrean fighter aircraft however, entered the No-Fly Zone from Asmara at different occasions to hit targets at Adigrate, Makale and other location in the area. Much civilian causality occurred as a result of these bombing raids. The Eritrean Air Force is equipped with high technology fighter aircraft like the Mig 29 that is capable of hitting targets deep inside Ethiopia.

1.17.4 Protection of Civil Aircraft

To prevent occurrence of accidents to civil aircraft operation as a result of military operations undertaken in the war affected areas; all civil aircraft are barred from operating in these affected regions by NOTAMs issued to declare the imposition of the airspace restriction. In addition, all traffic information on all aircraft that come under the control of the Addis Ababa Air Traffic Control Center are immediately given to the Military Command Post which uses these information to protect the civil aircraft from the negative impact of military operations. This arrangement has been in place ever since the war started and has proved to be a satisfactory method of keeping the safety of civil aviation.

2. Analysis

2.1 Ambiguities Surrounding N350JF

With the exception of the State of Registry, and the States that have lost their nationals in the accident, none of the organizations linked with the operation or ownership of N350JF have so far tried to contact the Ethiopian Civil Aviation Authority with regard to the loss of N350JF. Attempts to establish the existence of some of the companies at addresses found in documents collected from the aircraft wreckage site through the country's foreign diplomatic missions have shown that some like Lamburne Corporation were in fact non-existent. Such findings and the lack of response from companies believed to be operators to notification messages, and to inquire on the aircraft, and its crew by the ECAA had created some doubts about the origin and mission of N350JF. The complete lack of reaction from companies that may call themselves an operator or owner of the aircraft led at first to the suspicion of the aircraft as a mercenary aircraft employed for military intelligence gathering by Eritrea.

To this day no company -be it an operator, owner or an insurance company- has contacted the ECAA. This has made the collection of evidence for the investigation effort also more difficult.

2.2 Actual route Flown by N350JF

N350JF was last known to have been airborne from Luxor at 1129 UTC on the 29th of August 1999. According to the flight plan, N350JF was expected to route on R775 from Luxor to over head Jeddah from where it was again expected to fly on R775 to Assab before joining the route W889 to Addis Ababa and G650 to Nairobi.

The flight was however, first heard talking on VHF 120.7 with Asmara Air Traffic Control while it was some where beyond position ULONI on the route UG650. As the Crew /ATC communication recorded on the aircraft CVR indicates, the flight was pre-planned to go on UG650 which was closed between Asmara and Addis Ababa. This was however; corrected later by Asmara Air Traffic Control which instructed N350JF to proceed on radial 100 from Asmara to positions SOLIR, ASSAB and PARIM from where it could enter the Addis Ababa FIR to fly to Nairobi.

Four minutes after reporting position Asmara; N350JF was heard reporting to Asmara Air Traffic Control establishing radial 100 on ASM VOR. There are however, evidences that indicate N350JF did not establish radial 100, but had actually headed on UG650 towards Addis Ababa. The CVR provides sufficient evidences that substantiate this conclusion. In the conversation between the Pilots made in reaction to Asmara's advice of the unsafe condition of their suggested route, and the instruction regarding to the new routing, the Captain is heard directing the Co-pilot to keep going direct. Put in his own words, the Captain is heard in the CVR saying "*just keep going direct otherwise we're going to be severely embarrassed they always say that but we always go this other route*".

One minute before reporting position Asmara, the Co-pilot is also heard saying, "*this is the border fifteen miles to the border*". Following this speech, the Captain is again heard saying, "*I want to go past Asmara and see*". Three minutes after reporting position Asmara; the Co-pilot is again heard saying; "*now we are three miles to Ethiopia*". These recorded speeches suggest that the crew was flying knowingly over a route that it was notified by Asmara to be closed and very unsafe.

Had N350JF been truly established on radial 100 from Asmara VOR as the crew had reported doing so, the flight would have remained at all times inside the Eritrean territory, at least 30 NM away from the Ethio-Eritrean border, and would not have encountered any danger.

It does not seem that the crew might have also misnavigated after passing Asmara. The aircraft was equipped with navigation instruments like VOR/DME, ADF, GPS etc. The crew could have easily determined the aircraft position by selecting the aircraft's airborne equipment-VOR/DME and ADF- to the ground facilities at Asmara Airport. And the aircraft GPS instrument could have been used to counter check these instruments as well. The crew did tune to ASM VOR, and the chance of making a wrong navigation is a very unlikely scenario.

Why did the crew avoided the route that it had stated in the flight plan, and decided to navigate on a route that it had no clearance? This question might not be answered completely. The aircraft was originally planned to make an intermediate stop at Jeddah, this was however changed later for reasons unknown, and the aircraft made a technical landing at Luxor. It is not known how much fuel had N350JF uplifted from Luxor. It appears that N350JF did not carry enough fuel to take it along the long and circuitous route to Nairobi. To circumvent this problem, the crew might have decided to navigate along the shortest and more direct route-

UG650-to Nairobi. The insistence of the crew on getting UG650 from Asmara Air Traffic Control indicates this decision. The estimated elapsed times for positions HHAA, HAAA, HKNA and the other locations on the flight plan corresponds to the distances on the route that N350JF had actually been cruising (UG650). All these evidences suggest that the crew has decided because of an insufficient fuel to make the trip along the shortest route-UG650- from the very beginning.

2.3 Handling of N350JF by Asmara Air Traffic Control

Upon initial contact on VHF, Asmara tried to verify if N350JF had been intending to go via the route W180 over the Red Sea after position ULONI. This route would have been the right flight path for N350JF, since it could not have continued on UG650, because of the closure of this route between Asmara and Addis Ababa.

When Asmara learned that N350JF was actually wanting to maintain UG650 all the way to Addis Ababa, it advised the flight the closure of this route between Addis Ababa and Asmara, and the risk of getting hit by a missile if it went through this closed air corridor. Asmara then instructed the crew to proceed on radial 100 to position SOLIR, ASSAB & PARIM after coming over head Asmara.

This routing instruction added extra miles to the distance N350JF had to cover. The flight should have been told to stick to the flight plan route and diverted quite early to proceed direct or on W180 to Assab. If this action was taken by Asmara, the crew could have saved time and fuel, and above all it could have been discouraged from trying to take a short cut by attempting to slip through a prohibited airspace as it did so when the flight came close to the Ethiopian border.

When the crew asked Asmara for direct routing on the ground that the flight would economize fuel on this fuel critical leg, Asmara falsely replied that it had no any contact with Addis Ababa Air Traffic Control. This reply however caused the Captain to conclude that establishing any form of contact with Addis Ababa Air Traffic Control was not possible. This is evidenced by his speech recorded in the CVR as he said the following “*so they are not talking so there is no contact through there*” after receiving Asmara’s reply of no contact with Addis Ababa. Why the idea of contacting the Addis Ababa Air Traffic Control on HF or VHF did not come to the crew at this point is difficult to reason out. There is surely, a little naivety

of the crew of not attempting to contact the ATC at Addis Ababa after getting such reply from Asmara.

Asmara knew that the Addis Ababa Air Traffic Control was on the air, but due to the conflict between the two countries, and the unresolved FIR question, Asmara did not want to bring the information to the ATC at Addis Ababa at this stage. Communication and cooperation for the coordination of international flights have not been smooth ever since the relation between the two countries deteriorated to an outbreak of a war. So when Asmara replied that it had no contact with the Addis Ababa Air Traffic Control, it wanted to mean that it did not want to talk to the Addis Ababa Air Traffic Control. Asmara knew that it could not have given direct routing to N350JF, since the airspace for the direct routing was not under its jurisdiction, but it could have given the Pilots the advice to contact the Addis Ababa Air Traffic Control for their request.

Though direct routing would not have been given by the ATC at Addis Ababa, the radio contact that N350JF could have initiated would have brought it to the knowledge of the ATC, and hence the Military command Post. There was great chance to avoid the accident had this been the case.

2.4 The Addis Ababa ATC knowledge of N350JF

The information possessed by the Addis Ababa Air Traffic Control Center came first from the overflight permission request which stated that N350JF was intending to fly over the Ethiopian airspace on the 29th of August 1999 during its trip from Jeddah to Nairobi. This request letter also carried a notification that assured Addis Ababa that the flight would avoid flying through the Eritrean airspace. The other information came from Cairo Air Traffic, and this one was actually a flight plan with information concerning the route N350JF was intending to use, and such other information like estimated time of departure Luxor, and elapsed times for FIR locations etc.

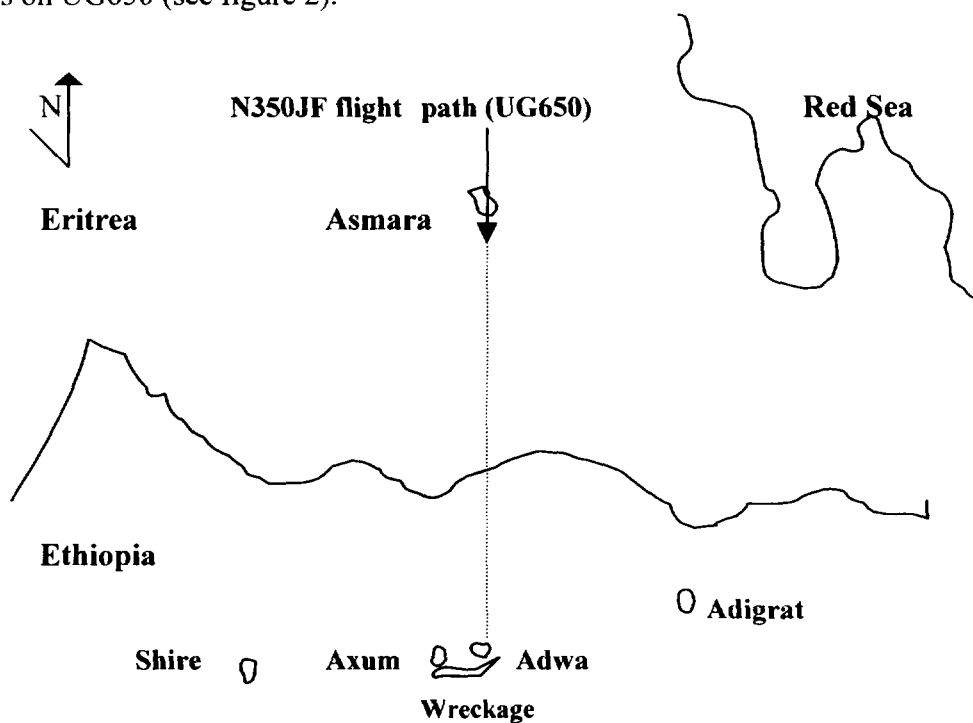
Therefore, the Air Traffic Control Center expected N350JF to come on R775 upto Assab, and then to join W889 according to the flight plan filed by the crew at Luxor. Since W889 was a withdrawn route, and very unsafe as well, the ATC was also in an urgent need of establishing contact with N350JF to reroute it to PARIM from where it could have been again routed to Nairobi along ATC specified routes. Apart from the flight plan, Addis Ababa did not

receive a departure message from Cairo and a FIR estimate either through AFTN or voice communication from Jeddah or Asmara.

Asmara however, came calling Addis Ababa on HF at 1352 UTC (see APP B) only when it has lost contact with N350JF, and there was a growing uncertainty about the safety of this flight. Asmara did then pass to Djibouti and Addis Ababa the traffic information it had on N350JF. This information however reached the Addis Ababa Air Traffic Control at a time (1356 UTC) it could not have been used to save N350JF from the tragic accident it had met.

2.5 Destruction of N350JF

The actual flight path of N350JF as determined from the Military radar and ATC information before this flight was finally terminated near the town of Adwa remained at all times on UG650 (see figure 2).



- N350JF was first observed around ASMARA by a Military Radar
- Its heading was 008 degrees magnetic
- N350JF was destroyed at around 1331 UTC, the wreckage fell 28 KM South of ADWA town

Figure 2

Using the time reference indicated by the Captain in the CVR, N350JF had presumably checked Asmara four or five minutes earlier than it had estimated Asmara. This flight had estimated Asmara at 1330 UTC.

Three minutes after the Co-pilot reported three miles to Ethiopia, an unusual bang that was loud enough to scare the crew is heard in the CVR. This happened at around 1331 UTC, and it is attributed to a missile exploding in the vicinity of the aircraft, and probably the aircraft getting hit by the fragments. By the time this bang occurred, the aircraft is assumed to be 18 NM inside the Ethiopian territory when computed at the speed of the aircraft -7 NM per minute-used by the crew for elapsed time calculation. This indicates that N350JF was approaching the town of Adwa when the challenge to its forward progress came from the Ground Force. The army accepted hitting the aircraft by a ground to air missile south of Adwa town at 1335 UTC. This statement of the Defense Force highly corresponds to evidences derived from the CVR with regard to the time, location and altitude of the missile attack on the LearJet aircraft.

At 7 NM a minute, N350JF would have taken from Asmara only less than six minutes to reach the Ethio-Eritreian border, behind which lay the Bademe and Zala Anbessa Fronts heavily defended with anti-aircraft guns and missiles. So any positive identification of the aircraft should have been completed before the aircraft crossed the common border. This would have been possible only if the Air Traffic Control at Addis Ababa had prior knowledge of the aircraft obtained in accordance with the internationally accepted rules of the air and norms. That is, the flight should have contacted Addis Ababa at least ten minutes before entering the FIR, and departure and FIR estimates should have been given by adjacent Air Traffic Control Centers to Addis Ababa. Unfortunately, none of these actions were taken by Jeddah, Asmara or the flight to inform the Air Traffic Control at Addis Ababa about the exact location, time and intention of N350JF.

Therefore, by the time N350JF came over the war zone, it was completely unknown to the ATC, and hence the Military Command Post. The radar detection of the aircraft before it crossed the border simply served to warn the military the coming of a threat. The military radar had no capability of identifying whether an aircraft detected by it is civil or military. The military stated that it had attempted to contact the aircraft by a radio, though it is not known on what frequency. The CVR does not indicate the occurrence of such attempt.

Any attempt to identify the aircraft -by intercepting it with a fighter airplane for instance - once it was inside the war zone, would have taken several minutes which meant facing a high risk of getting hit, and taking extreme casualties if the threat had been real. This was not in the objective of the military, which stood alert to prevent any causality that may be

inflicted by the enemy. So the action taken by the military was justified from the military point of view of defending the country.

It appears that N350JF did not receive direct hit by the missile, but might have suffered major damages to its structure from flying fragments released by the missile explosion. It looks then that N350JF has descended uncontrollably to the ground before it broke up due to aerodynamic forces into five parts and fell on the ground. The wreckage scattered over an area of radius 300 meters. Both engines did not show any power impact. It seems that the aircraft has descended to the ground with both engines off. Except the right engine, which is severely attacked by fire, there is no any indication of fire on the other wreckage parts.

3. Conclusions

3.1 Findings

1. The crew was properly licensed and rated.
2. The crew received the following warnings from Asmara Air Traffic Control:
 - A. The route (UG650) which N350JF intended to continue flying over was closed before one year.
 - B. the route (UG650) for the intended journey was a danger area and a war zone.
 - C. the aircraft (N350JF) would be hit by a missile if it simply went through the no-fly zone.
 - D. N350JF was instructed by Asmara to be strictly established on radial 100 from ASM VOR.
3. N350JF was cruising on ATS route UG650 not specified in its flight plan before it was told by Asmara to proceed on radial 100 from Asmara VOR.
4. N350JF continued cruising on ATS route UG650 even after passing Asmara despite the instruction given by Asmara to divert its track to radial 100.
5. The Addis Ababa Air Traffic Control Center was not informed of the exact location and intention of N350JF by adjacent Air Traffic Control Centers, which had control of N350JF before this flight, entered the Addis Ababa FIR.

6. The crew is suspected of using the overflight permission it had for Ethiopia as an excuse for breaching the airspace restriction.
7. The crew might have mistakenly believed that the aircraft was well out of missile range at 41 thousands feet and so might have daringly entered the no-fly zone knowing well that it was prohibited to all flights and very unsafe.
8. The crew seemed to have been short of aircraft fuel to complete the journey via the diversion route as a result of inadequate preparation for the trip.
9. The military perceived N350JF as an Eritrean aircraft with hostile intentions.
10. Identification of N350JF was not practical once this flight entered the war zone since any attempt would have taken long time which the military did not want because of the adverse effect of taking casualties if this aircraft had been a hostile enemy aircraft.
11. Lack of smooth communication between the two Air Traffic Control Centers- Addis Ababa and Asmara- as a result of the war and the FIR question prevented information from reaching the ATC at Addis Ababa in good time to protect N350JF from any danger.

3.2 Probable Cause

While flying in a no-fly zone- a route closed by a NOTAM- N350JF was mistaken for an Eritrean fighter aircraft with a hostile intention, and hence was hit by a missile fired by the Ethiopian Defense Force and destroyed.

4. Safety Recommendation

Adjacent Air Traffic Control Centers that may have international flights crossing through the air spaces of both Ethiopia and Eritrea shall coordinate these flights with both these countries until the FIR question is finally resolved. These adjacent ATC centers shall also advise these flights to establish radio contact ahead of time with the Air Traffic Control Centers of both Ethiopia and Eritrea so that their safety is protected by the availability of the required information at the disposal of the Air Traffic Control units of these unfriendly countries.

Appendix A(Cockpit Voice Recorder Transcript)

In the Transcript the terms P1 and P2 are used to differentiate the crew.

P1= Crew member with English accent.

P2= Crew member with Scandinavian accent.

(.....) Indicates indecipherable words

(you mean) Indicates uncertain words

[xxxxx] Indicates sounds or comments

TIMES are given in minutes and seconds from the start of recording

App. A

TIME	FROM	TO	INTELLIGENCE	ORIGIN	COMMENTS
00:00.0			START		Start of recording
	ATC	350JF	After ULONI you (.....) go to (.....)		(distorted-tape damage)
	350JF	ATC	After ULONI its ah Alpha Sierra Mike and then ah its Echo tango Kilo Echo Tango	P2	
	ATC	350JF	Roger (sir that) uhh after Asmara after IMDAX you will be proceed via whisky one eight zero		
	350JF	ATC	hold on	P2	
			[sounds of rustling paper]		
			I need another chart	P2	
			Yeh There's a chart there	P1	
00:51.3	ATC	350JF	November juliet fox Asmara	ATC	
00:55.2	350JF	ATC	Go ahead	P2	
00:56.5	ATC	350JF	Okay sir after Asmara you proceed ah via Whisky one eight Zero ahh via TESOT SOLIR and Sierra Bravo to PARIM confirm?	ATC	
01:07.3	350JF	ATC	Ah we.. after Asmara we proceed via umber Golf six five oh	P2	
01:21.0	ATC	350JF	Confirm ah alpha golf six five oh	ATC	
01:24.7	350JF	ATC	Uniform Golf six five zero after Asmara	P2	
01:31.6	ATC	350JF	Oh	ATC	
			(four) minutes (.....) a flight plan thats (.....)	P1	
			(Unintelligible words)		
			[Yawn]		
			(.....) for a cup of coffee but (.....)	P2	
			[Laughing]		
			thats why (.....) put water in the thing if it hasn't been used for five years (.....)	P1	
			Ah yeh	P2	
02:06.8	ATC	350JF	November three five zero juliet fox Asmara		
	350JF	ATC	go ahead	P2	
	ATC	350JF	sir it is better you proceed via.. after Asmerah via radial one zero zero ah for your safety (correct) is not ah is not safety	ATC	
02:24.5	350JF	ATC	Ah could you say again radial after Asmara	P2	

TIME	FROM	TO	INTELLIGENCE	ORIGIN	COMMENTS
02:27.7	ATC	350JF	After Asmara you must ah proceed via radial one zero zero to SOLIR and Sierra Bravo because ah (corrette) is ah not safety (here sir) at this time.	ATC	
02:39.9	350JF	ATC	Okay after Asmara radial ah one hundred	P2	
02:45.5	ATC	350JF	One hundred and then ah you proceed via SOLIR Sierra Bravo and eh PARIM over	ATC	
02:57.1	350JF	ATC	Could you say again that routing	P2	
03:00.0	ATC	350JF	Routing eh hh after ah hh after Asmara you proceed via radial one zero zero ah via SOLIR, SOLIR and eh Sierra Bravo after Sierra Bravo you proceed to ah PARIM PARIM after PARIM you proceed via Djibouti this is ah safety (.....)	ATC	
03:29.0	350JF	ATC	Ah stand by	P2	
04:03.9			[sound of paper rustling]		
04:22.9	350JF	ATC	So um we are to proceed radial one hundred and then to Sierra Bravo and then ah Whisky eight eight nine	P2	
04:35.7	ATC	350JF	Ah from Sierra Bravo you proceed direct to PARIM PARIM over	ATC	
04:42.9	350JF	ATC	PARIM after Sierra Bravo	P2	
04:46.8	ATC	350JF	affirmative PARIM and then after PARIM proceed via Djibouti direct to Nairobi that is the safety flight	ATC	
04:52.6	350JF	ATC	Ah roger	P2	
04:54.6	ATC	350JF	(....)estimate eh hh SOLIR Sierra Bravo and eh PARIM over	ATC	
05:02.3	350JF	ATC	ah roger stand by	P2	
05:25.7			Now we ah we have ah trouble	P2	
			[rustling paper sound]		
			offer you a cup of tea	P1	
05:34.0			yeh now he wants from Asmara to go out radial one hundred and go via the Sierra Bravo to Djibouti (.....)	P2	
			yeh keep on trucking down (here I think)	P1	
06:00.4			you know due to the war between Ethiopia and ah ah (Aus) Eritera	P2	
06:08.7			Yeh they always umm (.....)	P1	
			May be	P2	
			Keep on keep on going direct cos its not (.....)	P1	
06:23.2			yeh but may be you you could talk to (.....)	P2	

TIME	FROM	TO	INTELLIGENCE	ORIGIN	COMMENTS
06:43.3			yeh just keep going direct otherwise we're going to be severely embarrassed they always say that but we always go this other route	P1	
			After Asmara radial one hundred an onto Sierra Bravo and ah	P2	
07:48.1			yeh	P1	
			Was that one you were speaking to on HF or VHF	P1	
45:23.8			no one two zero seven	P2	
08:21.8	350JF	ATC	Asmara November three five zero Juliet fox	P1	
08:38.3			He's got to be joking	P1	
08:42.4			He wants you to go overhead Djibouti !	P1	
			Yes	P2	
08:45.4			He's (.....) insane (.....)	P1	
			[exclamation] that	P1	
			[sound of rustling paper]		
09:01.5			and you also ahhh Sierra Bravo (.....)	P2	
09:21.4			now They always stuff you around here and ah such like..... but thats not whats yeh	P1	
09:38.5	350JF	ATC	Asmara three five zero juliet fox	P1	
09:41.6	ATC	350JF	(niner) three five zero juliet fox go ahead	ATC	
09:45.7	350JF	ATC	yeh three five juliet fox this is a very fuel critical leg for us and there was nothing is NOTAMS about um and route restriction. What is the reason for ah routing us out towards Djibouti ?	P1	
10:03.4	ATC	350JF	Confirm your ahhhh say again say again	P1	
10:08.0	350JF	ATC	I say we are on a fuel critical leg on this route Djibout is way out of our way what is the reason for this routing ?	P1	
	ATC	350JF	Ah you mean why don't you going via correction?	ATC	
10:26.8	350JF	ATC	We wish to proceed from Asmara to over Addis	P1	
10:31.0	ATC	350JF	Yes sir (.....) this ah route ah specially route (connect) was closed before ah before one year so is a danger area we don't have any contact with Ethiopian Air over	ATC	
10:49.3	350JF	ATC	Oh I see ah (....) we can ah we can accept that but we'd prefer a direct routing please	P1	
			you mean this(connect) is under a war zone war zone.....		

TIME	FROM	TO	INTELLIGENCE	ORIGIN	COMMENTS
11:01.9			You got the other chart	P1	
11:02.8	ATC	350JF so for the safety is really dangerous because you when you pass like this flight you may be get any missile so you must ahh for your safety you proceed via radial one zero zero	ATC	
11:21.2			Above the cloud	P1	
			yes	P2	
11:26.3			(.....) put that (one)	P1	
11:31.6			see if there's anything there	P1	
11:41.3	ATC	350JF	November ah zero fox Asmara	ATC	
	350JF	ATC	go ahead	P1	
11:46.5	ATC	350JF	Sir you you don't know this ah route closed before one year ?	ATC	
	350JF	ATC	Negative	P1	
11:52.8	ATC	350JF	(.....) before one year was closed this (green) six five zero (.....) (connect) every because of this danger area	ATC	
11:59.8	350JF	ATC	I see	P1	
			[Singing]	P1	
12:22.5			Its because they're not talking to them in there	P1	
12:26.6			so there's no contact through there	P1	
			(all over)	P1	
13:09.7			You think we go over that one	P2	
13:17.1			uhhhhhh	P1	
13:19.5			we can always climb	P1	
			what	P2	
13:22.9			can always climb	P1	
			yes	P2	
13:28.5			want to go to four one zero	P1	
13:31.1			why not	P2	
13:34.2	350JF	ATC	(.....) three five zero juliet foxtrot we'd like to request level four one zero please	P1	
13:44.2	ATC	350JF	Ah roger recleared flight level four one zero report maintaining	ATC	
13:47.4	350JF	ATC	re-cleared four one zero call you when maintaining	P1	
13:50.2	ATC	350JF	Do you have estimates for the for SOLIR Sierra Bravo and the PARIM	ATC	

TIME	FROM	TO	INTELLIGENCE	ORIGIN	COMMENTS
13:54.8	350JF	ATC	Stand by	P1	
13:56.9	P1		Where did he say you got them written down somewhere	P1	
	P2		(.....)	P2	
14:06.9			you got your Nav log there somewhere	P1	
			(yeh I do) (.....)	P2	
			uh uh	P1	
15:04.5			He said he wanted us to route out via	P1	
15:07.8			radial one hundred from (Asmara)	P2	
			Ah yes	P1	
			(.....)	P1	
15:26.0	350JF	ATC	Ah three five juliet fox what were the estimates you wanted	P1	
	(ATC)		(.....)		
15:36.6	ATC	350JF	November juliet fox Asmara	ATC	
15:41.8	350JF	ATC	yes what were the estimate points you wanted	P1	
15:45.0	ATC	350JF	okay after Asmara you proceed via radial one zero zero and estimate SOLIR SOLIR Sierra Bravo estimate PARIM	ATC	
			(.....)		
16:03.9			[TONE]		
16:05.2			[Exclamation] knows what ah what he's talking about there on those estimates but	P1	
16:09.9			(Thats)	P1	
16:12.5			two hundred and fifty miles at	P1	
16:17.9			seven miles a minute	P1	
16:44.2			(Four) zero six	P1	
16:46.8			(four) zero six	P1	
17:16.4	350JF	ATC	three five zero juliet fox we're levelling flight level four one zero we'll be Asmara time three zero and ah Sierra Bravo time one four zero six.	P1	
17:33.5	ATC	350JF	And estimate um PARIM PARIM	ATC	
17:36.6			Its not on the [exclamation] chart here	P1	
17:38.3			No I couldn't find it either	P2	
17:43.3	350JF	ATC	Ah the position does not seem to be on our chart sir can you tell me where it is?	P1	

TIME	FROM	TO	INTELLIGENCE	ORIGIN	COMMENTS
17:49.4	ATC	350JF	After ah after ah Sierra Bravo you proceed ah PARIM PARIM		
			exit point of ah between Djibouti and Eritrean territory	ATC	
18:06.0			Ah PARIM	P1	
18:06.5			I don't find it	P2	
18:08.9			Yeh	P1	
18:24.4			I'll look on my other chart	P1	
18:28.3			[exclamation] stroll on	P1	
			[Sounds of paper rustling]		
18:48.3	ATC	350JF	Ah november juliet fox Asmara	ATC	
18:53.2	350JF	ATC	Go ahead	P1	
18:54.3	ATC	350JF	okay sir after ah estimate PARIM (I suppose) one four one four	ATC	
19:00.6	350JF	ATC	Yeh stand by I'm looking for it on my chart it doesn't appear to be here I'll get another one	P1	
19:05.6	ATC	350JF	(..) from Sierra Bravo to PARIM ahhh it will be takes ah eight minutes	ATC	
19:10.2			You what!!	P1	
19:29.6			I mean we got hours and [exclamation] hours I don't know what he's so impatient about	P1	
19:31.4			Well its not on this one it ain't there	P1	
20:31.6			Well now we are approaching Asmara	P2	
20:35.7			yeh ah just keep trucking	P1	
20:38.3			yes	P2	
20:44.1			Its its very close to the border here so may be asked for direct we have overflying permission for Ethiopia (....)	P2	
20:53.5			Yes yes [over last word above]	P1	
21:26.4			This (.....) point he's talking about doesn't exist on our charts	P1	
			no	P2	
21:42.8	350JF	ATC	And three five zero juliet fox sorry sir am we're on charts are dated June ninety nine we can not find that position can you spell it for us	P1	
21:52.8	ATC	350JF	Say again sir	ATC	

TIME	FROM	TO	INTELLIGENCE	ORIGIN	COMMENTS
21:54.5	350JF	ATC	Can you spell that position for us	P1	
22:00.8	ATC	350JF	Papa Alpha Romo India Mike I say again Papa Alpha Romeo India Mike	ATC	
22:12.3	350JF	ATC	And ah whereabouts does it lie from Sierra Bravo	P1	
22:16.2	ATC	350JF	From Sierra Bravo direct to PARIM ah it will be take eight minutes	ATC	
22:22.5			You what	P1	
			I don't know	P2	
22:24.9	350JF	ATC	yeh we're not reading you on there say again from Sierra Bravo	P1	
22:29.6	ATC	350JF	is ah from Sierra Bravo to PARIM only will be eight ..six.. eight eight minutes	ATC	
22:37.4	350JF	ATC	Eight minutes we don't where it is	P1	
22:40.5	ATC	350JF	ah (...) this is ahh in the Eritrean boundary FIR	ATC	
			Ah we found it	P1	
22:47.4	350JF	ATC	Oh roger we've found it now so I'me sorry	P1	
22:51.9			Oh no no no he thinks we're coming ah	P1	
22:53.3	ATC	350JF	Ok report overhead Asmara	ATC	
	350JF	ATC	(Will do)	P1	
			We are (.....)here		
			Sorry		
			(.....)		
			(yeh) (its here)		
23:26.4			Otherwise we'll never get there	P1	
23:36.6			(A few) charlie bravo's around there are there. (there they are)	P1	
24:05.0			Its fifty eight miles to (and then from)	P1	
24:09.3			This is the border fifteen miles to the border	P2	
24:17.5			Yeh	P1	
24:19.2			Well that position that we gave him it was ah it was Sierra Bravo I wrote it down somewhere	P1	
24:24.0			Yeh its here		
24:25.1			Sierra Bravo there we are its fifty eight miles at seven miles a minute call it sixty thats ten... be nine minutes one five	P1	
24:39.0			I want to go past Asmara to see		

TIME	FROM	TO	INTELLIGENCE	ORIGIN	COMMENTS
25:34.6	350JF	ATC	and November three five zero juliet fox cheking Asmara level four one zero Sierra Bravo time one four zero six and at PARIM one four one five	P1	
25:51.5	ATC	350JF	Roger sir report establish strictly radial ah one zero zero out bound	ATC	
25:58.9			Report Strictly radial one hundred	P2	
26:03.6	350JF	ATC	Yes ah call you established radial one hundred	P1	
26:06.5	ATC	350JF	Affirmative over	ATC	
26:08.0	350JF	ATC	Thank you	P1	
26:12.1			Just check if its operating	P1	
26:16.9			because its not you see	P1	
26:19.0			That VOR's	P1	
28:27.5			There are one or two embedded ones here look	P1	
28:29.4			Yes	P2	
28:32.7			Now we are ah three miles to Ethiopia	P2	
28:38.5			yeh	P1	
28:41.6			two and a half thousand pounds gone	P1	
28:44.8			we've been airborne	P1	
28:48.0			what	P1	
28:50.0			eleven	P1	
28:53.7			(twenty one)	P1	
28:55.2			Been airborne two hours exactly	P1	
29:06.2			five fifty	P1	
29:13.4			that's saved another sixty pounds	P1	
29:19.7			burning about eleven forty eleven fifty pounds an hour	P1	
			Ah yeh	P2	
29:29.8	350JF	ATC	three five zero juliet fox on the one hundred radial level four one zero	P1	
29:35.0	ATC	350JF	Report position ah report ah one hundred DME from Asmara	ATC	
29:41.1	350JF	ATC	Call you one hundred DME thank you three five zero juliet fox	P1	
30:13.0			(excalmation oiyy) take some of this fuel out the fuselage	P1	
30:16.7			(oh I go down)	P1	
30:40.3			so thats two hours	P1	

App. A

TIME	FROM	TO	INTELLIGENCE	ORIGIN	COMMENTS
30:43.3			to get to Asmara	P1	
30:46.7			thats two hours	P1	
30:52.4			forty five	P1	
31:01.3			fifteen minutes longer	P1	
31:10.4			one hour	P1	
31:13.6			one hour thirty	P1	
31:16.2			another hour forty five	P1	
31:24.5			about another two hours	P1	
31:32.5			two hours forty	P1	
31:35.5			two hours forty		
31:37.0			[BANG]		
31:37.9			[Exclamation] what the hell was that	P1	
31:39.4			what was that	P2	
31:42.4			it was lightning I think	P1	
31:48.0			[exclamation]	P1	
31:51.3			you can't see anything	P2	
31:53.0			no	P1	
31:58.4			[click sound]		
			[noise]		
32:22.3			or was it a SAM	P2	
32:25.1			Yes	P1	
			Yeh	P1	
32:26.4			what	P2	
32:27.2			not at this height though	P1	
32:32.4			END of recording		

Appendix B (ATC Tape Transcript)

Date: 29 August 1999

Radio Frequency - HF 11300 Khz and 7595 Khz

Time: 1300 - 1430 UTC

Time	From/Station	To/Station	Text of Communication	Remarks
1347	Asmara	N350JF	N350JF Asmara	Asmara is calling N350JF but no reply
	Asmara	N350JF	N350JF Asmara	No reply
1349	Asmara	N350JF	N350JF Asmara	No reply
	Asmara	Djibouti	Djibouti Djibouti Asmara	No reply
	Asmara	Djibouti	Djibouti Asmara	No reply
1351	Asmara	Djibouti	Djibouti, Djibouti Asmara	No reply
	Asmara	Djibouti	Djibouti, Djibouti Asmara	
1351	Djibouti	Asmara	Asmara Djibouti	
1351	Asmara	Djibouti	Do you have contact with N350JF	
	Djibouti	Asmara	Negative and	
1352	Asmara	Djibouti	AH - Estimate PARIM 140 - AH 1415 level 310 over!	
1352	Djibouti	Asmara	Copied, copied	
1352	Asmara	Djibouti	Roger	
1352	Asmara	Addis	Addis, Addis Asmara	No reply
			Addis, Addis Asmara	No reply
			Addis, Addis Asmara	No reply
1353/54	Asmara	Addis	Addis, Addis Asmara	No reply
	Asmara	Addis	Addis, Addis Asmara	No reply
	Asmara	Addis	Addis, Addis Asmara	No reply
	Djibouti	Asmara	Asmara Djibouti	
	Asmara	Djibouti	AH- Go ahead	
	Djibouti	Asmara	Confirm you are calling Addis?	

Time	From/Station	To/Station	Text of Communication	Remarks
1353	Asmara	Djibouti	AH - Confirm copied on N350J Addis Abeba?	
	Djibouti	Asmara	AH- standby - Break Addis Abeba Djibouti	
	Djibouti	Asmara	Asmara 75 - 75	
	Asmara	Djibouti	Thank you	
1354	Asmara	Addis	Addis - Addis Asmara	
	Asmara	Addis	Addis - Addis Asmara	
	Addis	Asmara	Asmara Addis	
	Asmara	Addis	Addis good after noon did you copy on N350JF type L35 from LUXOR to Nairobi estimate PARIM 1415 level 410 over?	
1355	Addis	Asmara	Roger copied, PARIM 1415 flight level 410 confirm via APDOS?	
1355	Asmara	Addis	AH- flight was routing via, affirmative " - APDOS PARIM estimate PARIM 1415 370	
1355	Addis	Asmara	Roger, roger copied do you have time estimate APDOS?	
1355	Asmara	Addis	AH- standby Sir, ok, No contact standby, standby. I will call you	
	Addis	Asmara	Roger	
1356/57	Asmara	Addis	Addis Asmara	
	Addis	Asmara	Go ahead Asmara	
	Asmara	Addis	Addis Addis /Asmara	
1356	Addis	Asmara	Asmara Addis Go ahead	
	Asmara	Addis	Roger, the flight N350JF coming via RASKA, Asmara and SB to PARIM over	
1357	Addis	Asmara	Confirm negative via APDOS?	
	Asmara	Addis	Affirmative via SB to PARIM not, APDOS	
	Addis	Asmara	Roger	
1405/06	Addis	Sanna	Sanna Addis	
	Sanna	Addis	Addis Sanna Go ahead	
	Addis	Sanna	do you have contact with N350JF?	
	Sanna	Addis	Negative, No contact	

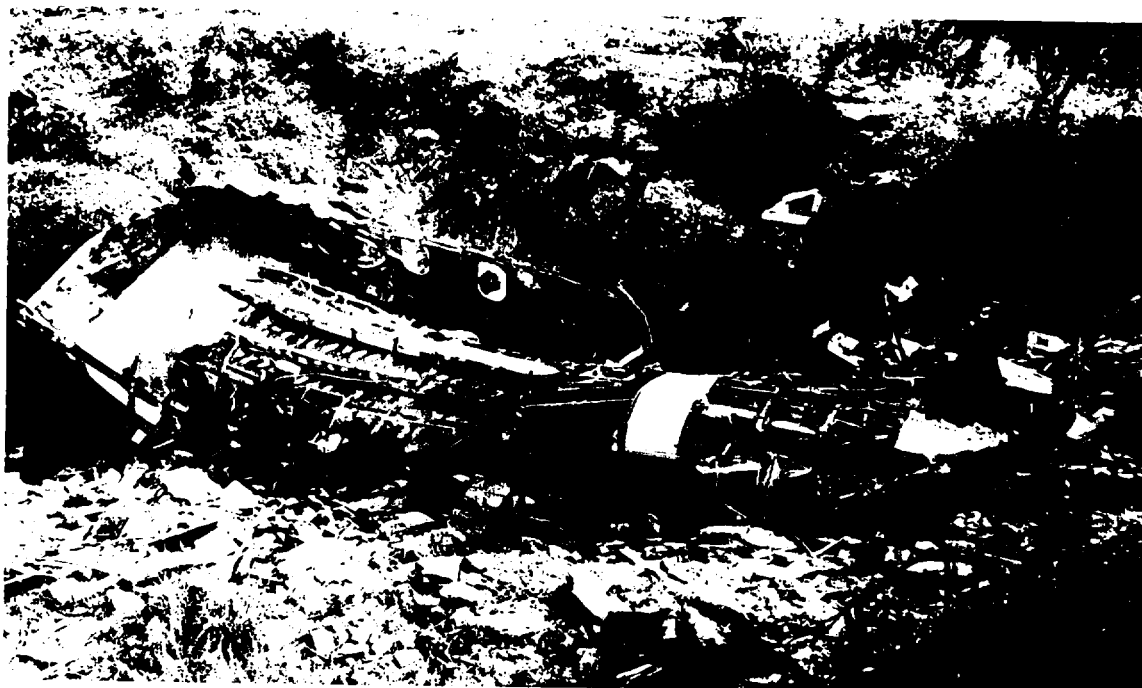
Time	From/Station	To/Station	Text of Communication	Remarks
1406	Addis Sanna Addis	Sanna Addis Sanna	Roger, esimate PARIM 1415 Say again? N350JF type of aircraft LR35 from LUXOR to Nairobi Jomokenyata flight level 350 and estimate PARIM 1415	
	Sanna Addis Sanna	Addis Sanna Addis	Roger, Roger If you in contact with the flight release on 7595 or 11300 Roger, Roger	
1413	Asmara Asmara Djibouti Asmara Djibouti Asmara Addis	Djibouti Djibouti Asmara Djibouti Asmara Djibouti Asmara	Djibouti, Djibouti Asmara Djibouti, Asmara Asmara, Djibouti Do you have contact with N350JF? No contact, no contact Roger	
1414	Djibouti Addis Asmara Addis	Asmara Asmara Addis Asmara	Asmara Addis No contact, no contact Asmara Addis Addis Asmara go ahead Confirm 350 after PARIM?	
1415	Asmara Addis Asmara Addis Asmara	Addis Asmara Addis Asmara Addis	Say again? Confirm 350 after PARIM on N350JF? A/K-Say again, say again Sir? Confirm flight level 350 on after PARIM/after position PARIM? We don't have contact, no contact, no contact with the flight sir, Flight level 410 no contact.	
	Addis	Asmara	Roger	
1426	Asmara Asmara Asmara Asmara Asmara	Addis Addis Addis Addis Addis	Addis Asmara Addis Addis, Asmara Addis Addis, Asmara Addis Addis, Asmara Addis Asmara	

Time	From/Station	To/Station	Text of Communication	Remarks
1428	Addis Djibouti Addis Djibouti Sanna	Djibouti Addis Djibouti Addis Addis	Sanna/Djibouti Addis Addis Ababa go ahead. Do you have contact with N350JF? Negative Negative Addis Sanna no contact. END OF THE TEXT	

Appendix C: Aircraft Wreckage Photographs



GENERAL TOPOGRAPHY OF THE WRECKAGE SITE



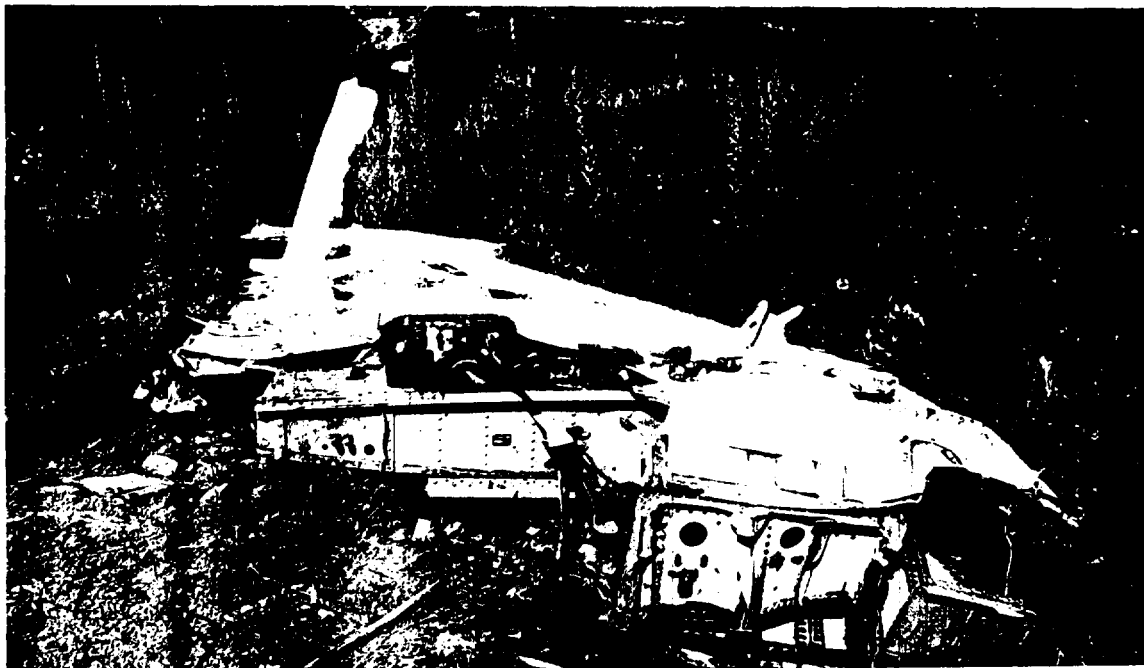
N350JF FUSELAGE WRECKAGE RESTING IN A DRY RIVER BED



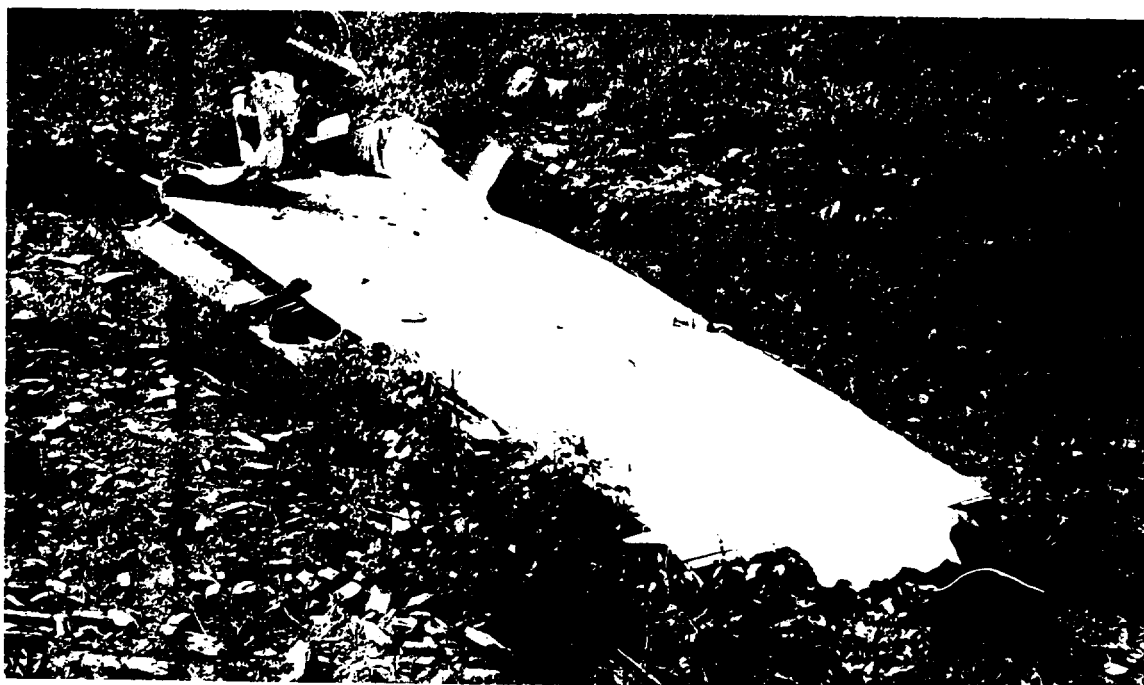
VERTICAL STABLIZER



RIGHT ENGINE RESTING ON THE SLOPING SIDE OF A HILL



RIGHT WING



LEFT WING

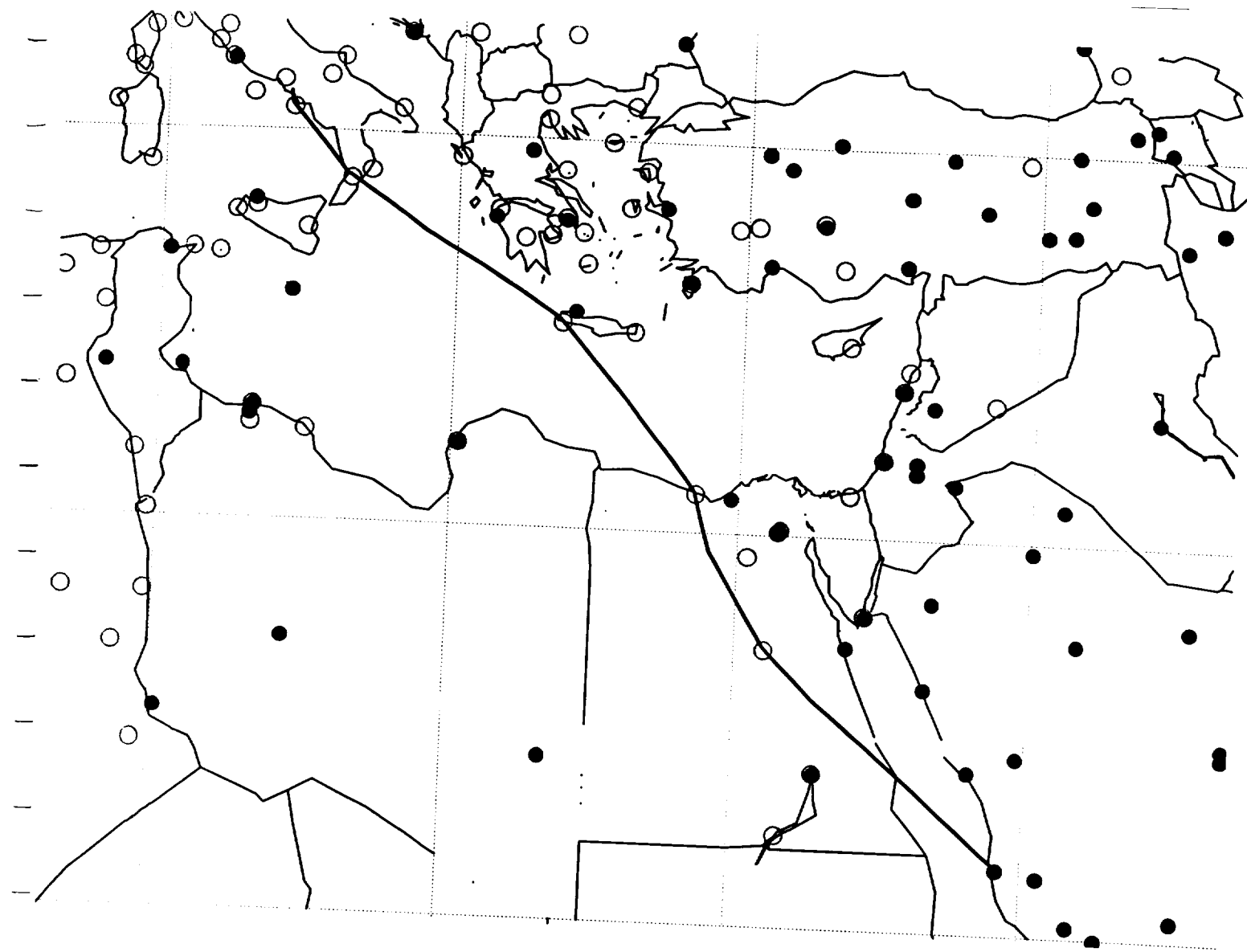


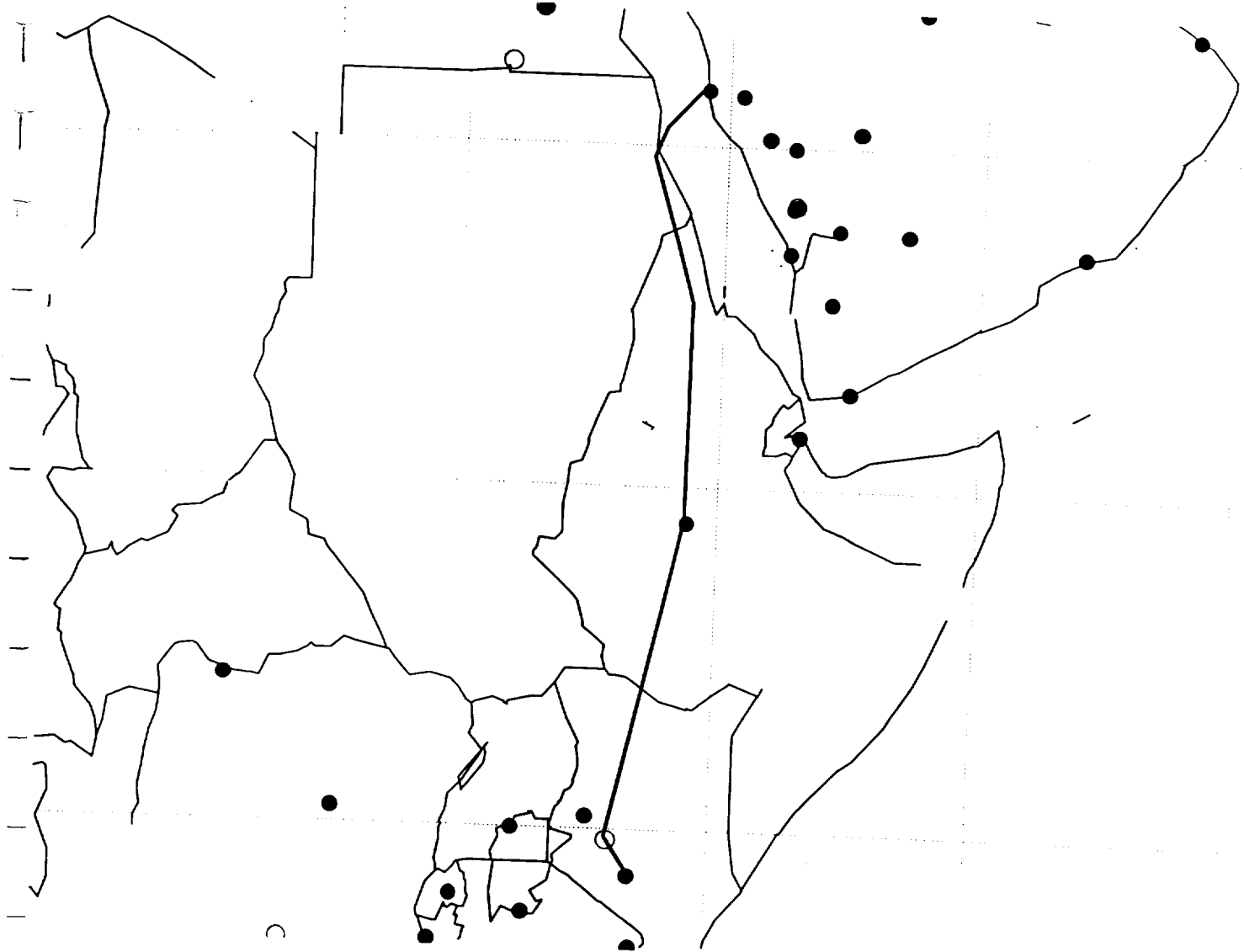
SEVERLY BURNT RIGHT ENGINE



LEFT ENGINE

**Appendix D: Flight Crew Projection
of the Proposed Routes for N350JF
as Obtained from a Laptop
Computer Recovered from the
Aircraft Wreckage**





Appendix E: En-route Chart

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SECRET

AIRSPACE CLASSIFICATION WITHIN
KHARTOUM FIR

Airways UA-10, UG-680 (Khartoum VORDME
- Port Sudan ND85 & UB-526 - class (A)
Airways A-10, G-680 - class (C)
Advisory routes - class (F)
FIS routes - class (G)

PORT SUDAN
TOWER
125.50
On Request

On Request
ATBARA
273 ATB
N17 41.3 E034 02.9

48

BELOW R 245(C)
117
UB 526 (217)

